PATENT ABSTRACTS OF JAPAN

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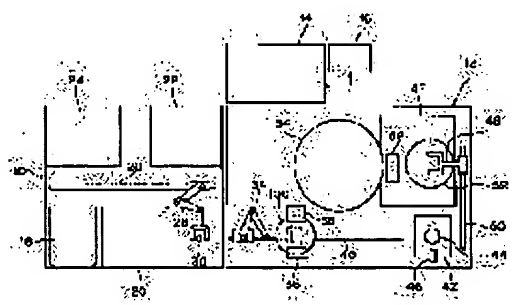
(54) ALIGNER AND ALIGNING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To enhance the throughput of aligner while keeping high alignment accuracy by determining new alignment conditions based on the past alignment conditions corresponding to those of a layer on a new substrate to be exposed and the residual error of alignment.
SOLUTION: A controller 14 retrieves past 'alignment conditions' and 'alignment residual error' corresponding to six parameters, i.e., name of work process, name of aligner, name of exposing reticle, name of alignment layer process, name of alignment aligner and name of alignment layer exposing reticle, from the data base of a memory 16. 'New alignment conditions' (correction parameters) of a wafer 100 to be aligned are determined based on the average value of retrieved data by subtracting the 'corresponding past alignment residual error' from the 'corresponding past alignment conditions'.



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CLAIMS

[Claim(s)]
[Claim 1] In the exposure approach which carries out alignment of at least one of the patterns which were made to put on two or more layers on a substrate mutually, respectively, and were formed, and the pattern on a mask, and forms the image of the pattern on said mask in the maximum upper layer of said substrate The alignment error between the patterns formed in said two or more layers, respectively For said every layer, match with the conditions about exposure and alignment, and it memorizes. It can set to at least one of said two or more layers corresponding to the exposure conditions set up to said maximum upper layer. Said memorized alignment error and the alignment conditions corresponding to it are read. The exposure approach which computes the alignment conditions in said maximum upper layer based on this information by which reading appearance was carried out, and is characterized by carrying out alignment of at least one pattern on said substrate, and the pattern on said mask according to the this computed alignment conditions.
[Claim 2] A part of conditions [at least] about the exposure and alignment for said every layer are the approach according to claim 1 characterized by being formed in said layer as identification code.
[Claim 3] The semiconductor device manufactured by the exposure approach of claim 1.
[Claim 4] In the aligner which carries out alignment of at least one of the patterns which were made to put on two or more layers on a substrate mutually, respectively, and were formed, and the pattern on a mask, and forms the image of the pattern on said mask in the maximum upper layer of said substrate The alignment error between the patterns formed in said two or more layers, respectively A storage means to match with the conditions about exposure and alignment, and to memorize for said every layer; It can set to at least one of said two or more layers corresponding to the exposure conditions set up to said maximum upper layer. Said memorized alignment error and the alignment conditions corresponding to it are read. An operation means to compute the alignment conditions in said maximum upper layer based on this information by which reading appearance was carried out; the alignment means which carries out alignment of at least one pattern on said substrate, and the pattern on said mask according to said computed alignment conditions The aligner characterized by having.
[Claim 5] Said alignment means is equipment according to claim 4 characterized by illuminating the alignment mark attached to at least one pattern on said substrate, having the mark detection system which carries out photoelectrical detection of the light generated from this alignment mark, and displacing said mask and said substrate relatively according to the output and said computed alignment conditions of this mark detection system.
[Claim 6] Equipment according to claim 4 or 5 characterized by having further a means to record a part of conditions [at least] about the exposure and alignment in said maximum upper layer on said maximum upper layer [claim 7] A part of conditions about said exposure and alignment are equipment according to claim 4 to 6 characterized by having further the reader which reads optically the conditions which are recorded on said layer and were this recorded, and is outputted to said operation means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the exposure approach and an aligner, especially, this invention is formed in the predetermined layer on a substrate, carries out alignment of a pattern and the pattern on a mask, and relates to the exposure approach and equipment which form the image of the pattern of a mask in the maximum upper layer of a substrate.
[0002]
[Background of the Invention] In the approach of forming two or more patterns in piles over a multilayer on a substrate (exposure), generally, in case a new pattern is exposed in the maximum upper layer, alignment of the pattern concerned is carried out to one of the patterns already formed. Drawing 5 shows an example of the conventional exposure approach. In this approach, selection of a routing, an aligner, and an exposure reticle is first performed as activity preparation. Next, alignment of the substrate is carried out on some alignment conditions, and test exposure (pilot processing or precedence processing) is performed. Next, the alignment residuum of the substrate exposed by the predetermined measuring instrument is measured. Consequently, this exposure is performed when an alignment residuum is below a predetermined reference value. On the other hand, when an alignment residuum is beyond a reference value, re-alignment of the substrate is carried out according to the alignment conditions which changed and changed alignment conditions based on the measured residuum, and this exposure is performed, or test exposure is performed again.
[0003]
[Problem(s) to be Solved by the Invention] By the above conventional approaches, when the exposure conditions of a substrate change, alignment conditions will change. That is, when the equipment which exposed the alignment layer in which the mark used as the criteria of alignment was formed when the substrate used for test exposure when a routing changed, an aligner changed and an exposure reticle changed changed changes, or when the reticle used for exposure of an alignment layer changes, alignment conditions will change. In order to maintain alignment precision, whenever alignment conditions change, it is necessary to redo test exposure, and there is un-arranging [that the part throughput falls].
[0004] Therefore, the purpose of this invention is to raise the throughput of an aligner, maintaining a high alignment precision.
[0005]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to the exposure approach of this invention. The alignment error between the patterns formed in two or more layers on a substrate, respectively For every layer, it matches with the conditions about exposure and alignment, memorizes, and can set to at least one of two or more layers corresponding to the exposure conditions set up to the maximum upper layer. The memorized alignment error and the alignment conditions corresponding to it are read. Based on this information by which reading appearance was carried out, the alignment conditions in the maximum upper layer are computed, and alignment of at least one pattern on a substrate and the pattern on a mask is carried out according to the this computed alignment conditions. Preferably, a part of conditions [at least] about the exposure and alignment for each class are formed in each class as identification code.
[0006] The aligner of this invention the alignment error between the patterns formed in two or more layers on a substrate, respectively It can set to at least one of two or more layers corresponding to the exposure conditions set up to the storage means and; maximum upper layer which match with the conditions about exposure and alignment, and are memorized for every layer. The memorized alignment error and the alignment conditions corresponding to it are read.

An operation means to compute the alignment conditions in the maximum upper layer based on this information by which reading appearance was carried out; it has the alignment means which carries out alignment of at least one pattern on a substrate, and the pattern on a mask according to the computed alignment conditions.
[0007] The alignment mark attached to at least one pattern on a substrate is illuminated, it has the mark detection system which carries out photoelectrical detection of the light generated from this alignment mark, and a mask and a substrate are made preferably displaced relatively with the above-mentioned alignment means according to the output of this mark detection system, and the computed alignment conditions. Moreover, it has a means to record a part of conditions [at least] about the exposure and alignment in the maximum upper layer of a substrate on the maximum upper layer concerned. Furthermore, the conditions which recorded a part of conditions about exposure and alignment on each class, and were this recorded by the reader are read optically, and it outputs to an operation means.
[0008]
[Function] In order that this invention may compute new alignment conditions by searching and referring to the alignment conditions of the already memorized past appropriately as mentioned above, also when the exposure conditions of a substrate etc. change, the time amount which it becomes unnecessary to newly perform test exposure, and determines alignment conditions compared with the former is shortened remarkably.
[0009]
[The mode of implementation of invention] Hereafter, the gestalt of operation of this invention is explained with reference to an example. This example applies this invention to the semi-conductor projection exposure system which carries out projection exposure of the pattern formed in the reticle on a wafer.
[0010]
[Example] Drawing 1 shows the exposure system of this example. This exposure system is equipped with coater developer equipment 10, the aligner 12 which exposes a wafer 100, the main control unit 14 which performs all-inclusive control of the whole system, and the storage 16 connected to the main control unit. Coater developer equipment 10 is equipped with the wafer cassette 18 which contains two or more wafers, the coater 20 which applies a photoresist to a wafer front face, the developer (developer) 22 which develops the wafer 100 after exposure, the test equipment 24 which measures the alignment error of the wafer 100 after development, and the articulated-robot arm 26 and guide rail 28 which perform conveyance of a wafer.
[0011] The aligner 12 is equipped with the articulated-robot arm 34 which delivers a wafer 100 between coater developer equipment 10, the bar code reader 36 which reads the bar code formed on the wafer 100, the laser-beam-machining equipment 38 which forms a bar code on a wafer 100, PURIARAIMENTO equipment 42, and the exposure section (47, 52, 54, 56). PURIARAIMENTO equipment 42 is equipped with the turntable 31 made to rotate the wafer 100 carried on it, and the sensor 46 which detects the orientation flat of a wafer 100. Conveyance and taking out of the wafer 100 to PURIARAIMENTO equipment 42 are performed by the articulated-robot arm 34 which moves in a guide 40 top. Moreover, conveyance of the wafer between PURIARAIMENTO equipment 42 and an aligner 12 is performed by the slider arm 48 which carries out the slider of the guide 50 top.
[0012] In drawing 1 , one of two or more wafers contained by the wafer cassette 18 is sampled with the articulated-robot arm 26, and the wafer 100 is conveyed to coater 20. The wafer 100 with which the photoresist was applied to the front face by coater 20 is conveyed to a position in readiness 30 by the robot arm 26. The wafer 100 of a position in readiness 30 is held at the articulated-robot arm 34 prepared in the aligner 12, and even the reader (bar code reader) 36 which reads the identification code (for example, bar code) formed in each class on a wafer 100 is conveyed. A reader 36 outputs the read information (conditions about the exposure when forming a pattern in each class, and alignment) to a main control unit 14.
[0013] The robot arm 34 moves further along with a guide 40, and delivers a wafer 100 to the turntable 44 of PURIARAIMENTO equipment 42. Rotating a wafer 100 on a turntable 44, it irradiates the parallel flux of light of non-exposing wavelength by the sensor 46 at the periphery section, and PURIARAIMENTO equipment 42 carries out photoelectrical detection of the flux of light which is not interrupted with a wafer 100. And rotation of a turntable 44 is stopped according to the output of a sensor 46, and the orientation flat of a wafer 100 is doubled in the predetermined direction. Then, a wafer is conveyed to the upper part of the wafer stage 47, and vacuum adsorption is carried out by the slider arm 48 at the wafer holder 52.
[0014] In two or more layers on a wafer 100, a pattern piles up, is formed and detects the alignment mark attached to the at least one pattern of two or more layers by the alignment sensor 56, respectively. And the wafer stage 47 is driven based on the predetermined amount of amendments (alignment conditions), and alignment of the pattern on a wafer 100 and the pattern on a reticle is carried out to the output of this alignment sensor 56. Then, the maximum upper layer on a wafer 100 (it is a wrap photoresist about it) is exposed by the image of the pattern on a reticle through projection optics

54. In addition, the calculation approach of the alignment conditions of a wafer 100 is explained in full detail behind.
[0015] By the slider arm 48, the wafer 100 by which superposition exposure of all the shot fields (pattern) was carried out by the pattern image of a reticle is taken out from the wafer stage 47, and is received and passed to the robot arm 34. Furthermore, a wafer 100 is conveyed by the robot arm 34 even to the laser-beam-machining equipment 38 which records the conditions about exposure and alignment on a wafer (the maximum upper layer) 100. Laser-beam-machining equipment 38 irradiates the laser beam of a wavelength region which exposes a photoresist on a wafer 100, and writes the conditions about exposure and alignment in a wafer (photoresist) 100 in the form of a bar code (or a figure and the alphabet).
[0016] Now, the wafer 100 with which various conditions were recorded is conveyed to a position in readiness 30 with the robot arm 34, and is further carried in to a developer 22 by the robot arm 26. The wafer 100 to which the development was performed with the developer 22 is carried in to test equipment 24 by the robot arm 26, and an alignment error is measured here. Test equipment 24 illuminates some shot fields on a wafer 100, respectively, and carries out photoelectrical detection of the light generated from a wafer 100 with an image sensor (for example, CCD). Furthermore, the picture signal from an image sensor is scanned with two or more scanning lines, the alignment error of the pattern formed in at least one layer on a wafer 100 and the pattern (resist pattern) which was exposed with the aligner 12 and which should be formed in the maximum upper layer is measured, and this measurement result is outputted to a main control unit 14.
[0017] Drawing 2 shows the configuration of the exposure section of an aligner 12. In drawing, the exposure light outputted from the exposure light source 60 illuminates the reticle 62 held in the reticle stage 64. The predetermined circuit pattern is formed in the reticle 62, and the pattern is projected on a wafer 100 through projection optics 54. the wafer stage 47 -- the stage drive system 68 -- the 2-dimensional XY direction -- a step -- it is movable. Alignment equipment 56 is specified quantity gap ****** from the optical axis of projection optics 54, and carries out photoelectrical detection of the alignment mark (not shown) attached to the shot field of a wafer 100. On the wafer stage 47, the reflective mirror 70 is fixed and the light outputted from an interferometer 72 is reflected. The light reflected by the reflective mirror 70 is received with an interferometer 72, and it has become as [detect / the location of the wafer stage 47]. The image formation property control unit 74 which controls the image formation property is connected to projection optics 54.
[0018] Drawing 3 shows the shot array of a wafer 100. The grid-like alignment marks Mxn and Myi by which photoelectrical detection is carried out by the alignment sensor 56 are formed in the street line of two or more shot fields ES1-ESN on a wafer 100. This example performs alignment of a wafer with the so-called EGA (en hunger strike global alignment) method. That is, the sample fields SA1-SA9 are chosen from from among two or more shot fields ES1-ESN, the alignment mark attached to these sample fields SA1-SA9 is detected, and a shot array coordinate (x y) is statistically searched for with a least square method.
[0019] Next, the exposure approach of a wafer 100 is explained with reference to the flow chart shown in drawing 4 . The exposure approach of this invention is performed based on the information saved in two databases and "the database 1" which are shown below, and the "database 2." At storage 16, the alignment residuum measured with test equipment 24 after exposure, and the exposure conditions and alignment conditions at the time of exposing are saved as "a database 1." The contents of "the database 1" are as follows.
(1) a routing -- a name -- (-- two --) -- exposure -- a device name -- (-- three --) -- exposure -- a reticle -- a name -- (-- four --) -- alignment -- a layer -- a process -- a name -- (-- five --) -- alignment -- a layer -- exposure -- a device name -- (-- six --) -- alignment -- a layer -- exposure -- a reticle -- a name -- (-- seven --) -- alignment -- conditions -- (-- eight --) -- alignment -- a residuum -- here -- alignment -- a layer -- having used it -- alignment -- a mark -- forming -- having -- **** -- a wafer -- 100 -- a top -- a layer -- it is .
[0020] The following amendment parameters are used as alignment conditions. First, it is (1) offset (x y) as an amendment parameter of the array coordinate of the shot field of a wafer 100.
(2) Scaling (x y)
(3) It is (5) shot scale-factor (6) shot rotation [0021] as perpendicularity (4) wafer rotation and an amendment parameter in each shot field. Wafer iD is recorded on each class of a wafer as "a database 2" for every exposure process. The contents of "the database 2" are as follows.
(1) Even if such information that is a routing name (2) exposure device name (3) exposure reticle name is not a wafer unit, it may be recorded on the lot unit which consists of two or more wafers.
[0022] In the exposure approach of this example, while selecting a routing, an aligner, and an exposure reticle as activity preparation first in advance of the alignment of a wafer 100, an alignment layer process name is specified. Next, the contents of the "database 1" saved by the main control unit 14 at the store 16 are read. On the other hand, the wafer

iD (database 2) of the wafer 100 which should be exposed is read by the bar code reader 36, and the read information is read into a main control unit 14. It means that the information on both "a database 1" and the "database 2" was read now into the main control unit 14. In addition, when a routing name and an alignment layer process name correspond by 1 to 1, "it is not necessary to specify an alignment layer process name in activity preparation."

[0023] In a main control unit 14, six parameters shown below are set up from the read information.

(1) routing name (2) exposure device name (3) exposure reticle name (4) alignment layer process name (5) alignment layer exposure device name (6) alignment layer exposure reticle name [0024 --] Next, a control unit 14 searches "the past alignment conditions" and past "alignment residuum" corresponding to the six above-mentioned parameters from the "database 1" of a store 16. At this time, the data to search may set up retrieval conditions like not all the past data but the "n newest data", or "the data within the newest n hours (or a day, the moon)." Thus, from the average of the searched data, the "new alignment conditions" (amendment parameter) of the wafer 100 which should be exposed is computed by the following formulas.

"New alignment conditions" = "the past alignment conditions of corresponding" - "Alignment residuum of the corresponding past"

Or depending on the system of coordinates of a vernier measuring machine (test equipment 24), it computes by the following formulas.

"New alignment condition" ="past alignment conditions of corresponding"+ "the alignment residuum of the corresponding past"

[0025] Next, a main control unit 14 amends the positional information of the wafer 100 detected by alignment equipment 56 according to the "new alignment conditions" computed as mentioned above, and performs alignment. That is, while driving the wafer stage 47 with a driving gear 68, the projection scale factor of projection optics 54 etc. is controlled by the image formation property control unit 74. A driving gear 68 performs it, migration of a wafer 100 acting as the monitor of the location (location of a wafer 100) of the wafer stage 47 with an interferometer 72. Sequential exposure of the image of the pattern on a reticle 62 is carried out to each shot fields ES1-ESN of a wafer 100 through projection optics 54 after alignment completion.

[0026] As mentioned above, although this invention was explained based on the example, this invention is not limited to this example and can be changed in the range which does not deviate from the summary as technical thought of this invention shown in the claim.

[0027]

[Effect of the Invention] In this invention explained above, past alignment conditions and a past alignment error are memorized for every layer. In order to read the past alignment conditions and past alignment residuum corresponding to the exposure conditions of the layer of the substrate newly exposed among the information memorized and to search for alignment conditions with the new substrate concerned based on the read information, The time amount which determines alignment conditions can be shortened and it is effective in a throughput improving.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] About the exposure approach and an aligner, especially, this invention is formed in the predetermined layer on a substrate, carries out alignment of a pattern and the pattern on a mask, and relates to the exposure approach and equipment which form the image of the pattern of a mask in the maximum upper layer of a substrate.

[Translation done.]

PRIOR ART

[Background of the Invention] In the approach of forming two or more patterns in piles over a multilayer on a substrate (exposure), generally, in case a new pattern is exposed in the maximum upper layer, alignment of the pattern concerned is carried out to one of the patterns already formed. Drawing 5 shows an example of the conventional exposure approach. In this approach, selection of a routing, an aligner, and an exposure reticle is first performed as activity preparation. Next, alignment of the substrate is carried out on some alignment conditions, and test exposure (pilot processing or precedence processing) is performed. Next, the alignment residuum of the substrate exposed by the predetermined measuring instrument is measured. Consequently, this exposure is performed when an alignment residuum is below a predetermined reference value. On the other hand, when an alignment residuum is beyond a reference value, re-alignment of the substrate is carried out according to the alignment conditions which changed and changed alignment conditions based on the measured residuum, and this exposure is performed, or test exposure is performed again.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] In this invention explained above, past alignment conditions and a past alignment error are memorized for every layer. In order to read the past alignment conditions and past alignment residuum corresponding to the exposure conditions of the layer of the substrate newly exposed among the information memorized and to search for alignment conditions with the new substrate concerned based on the read information, The time amount which determines alignment conditions can be shortened and it is effective in a throughput improving.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the above conventional approaches, when the exposure conditions of a substrate change, alignment conditions will change. That is, when the equipment which exposed the alignment layer in which the mark used as the criteria of alignment was formed when the substrate used for test exposure when a routing changed, an aligner changed and an exposure reticle changed changed changes, or when the reticle used for exposure of an alignment layer changes, alignment conditions will change. In order to maintain alignment precision, whenever alignment conditions change, it is necessary to redo test exposure, and there is un-arranging [that the part throughput falls].
[0004] Therefore, the purpose of this invention is to raise the throughput of an aligner, maintaining a high alignment precision.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to the exposure approach of this invention. The alignment error between the patterns formed in two or more layers on a substrate, respectively For every layer, it matches with the conditions about exposure and alignment, memorizes, and can set to at least one of two or more layers corresponding to the exposure conditions set up to the maximum upper layer. The memorized alignment error and the alignment conditions corresponding to it are read. Based on this information by which reading appearance was carried out, the alignment conditions in the maximum upper layer are computed, and alignment of at least one pattern on a substrate and the pattern on a mask is carried out according to the this computed alignment conditions. Preferably, a part of conditions [at least] about the exposure and alignment for each class are formed in each class as identification code.
[0006] The aligner of this invention the alignment error between the patterns formed in two or more layers on a substrate, respectively It can set to at least one of two or more layers corresponding to the exposure conditions set up to the storage means and; maximum upper layer which match with the conditions about exposure and alignment, and are memorized for every layer. The memorized alignment error and the alignment conditions corresponding to it are read. An operation means to compute the alignment conditions in the maximum upper layer based on this information by which reading appearance was carried out; it has the alignment means which carries out alignment of at least one pattern on a substrate, and the pattern on a mask according to the computed alignment conditions.
[0007] The alignment mark attached to at least one pattern on a substrate is illuminated, it has the mark detection system which carries out photoelectrical detection of the light generated from this alignment mark, and a mask and a substrate are made preferably displaced relatively with the above-mentioned alignment means according to the output of this mark detection system, and the computed alignment conditions. Moreover, it has a means to record a part of conditions [at least] about the exposure and alignment in the maximum upper layer of a substrate on the maximum upper layer concerned. Furthermore, the conditions which recorded a part of conditions about exposure and alignment on each class, and were this recorded by the reader are read optically, and it outputs to an operation means.

[Translation done.]

OPERATION

[Function] In order that this invention may compute new alignment conditions by searching and referring to the alignment conditions of the already memorized past appropriately as mentioned above, also when the exposure conditions of a substrate etc. change, the time amount which it becomes unnecessary to newly perform test exposure, and determines alignment conditions compared with the former is shortened remarkably.
[0009]
[The mode of implementation of invention] Hereafter, the gestalt of operation of this invention is explained with reference to an example. This example applies this invention to the semi-conductor projection exposure system which carries out projection exposure of the pattern formed in the reticle on a wafer.

[Translation done.]

EXAMPLE

[Example] Drawing 1 shows the exposure system of this example. This exposure system is equipped with coater developer equipment 10, the aligner 12 which exposes a wafer 100, the main control unit 14 which performs all-inclusive control of the whole system, and the storage 16 connected to the main control unit. Coater developer equipment 10 is equipped with the wafer cassette 18 which contains two or more wafers, the coater 20 which applies a photoresist to a wafer front face, the developer (developer) 22 which develops the wafer 100 after exposure, the test equipment 24 which measures the alignment error of the wafer 100 after development, and the articulated-robot arm 26 and guide rail 28 which perform conveyance of a wafer.
[0011] The aligner 12 is equipped with the articulated-robot arm 34 which delivers a wafer 100 between coater developer equipment 10, the bar code reader 36 which reads the bar code formed on the wafer 100, the laser-beam-machining equipment 38 which forms a bar code on a wafer 100, PURIARAIMENTO equipment 42, and the exposure section (47, 52, 54, 56). PURIARAIMENTO equipment 42 is equipped with the turntable 31 made to rotate the wafer 100 carried on it, and the sensor 46 which detects the orientation flat of a wafer 100. Conveyance and taking out of the wafer 100 to PURIARAIMENTO equipment 42 are performed by the articulated-robot arm 34 which moves in a guide 40 top. Moreover, conveyance of the wafer between PURIARAIMENTO equipment 42 and an aligner 12 is performed by the slider arm 48 which carries out the slider of the guide 50 top.
[0012] In drawing 1 , one of two or more wafers contained by the wafer cassette 18 is sampled with the articulated-robot arm 26, and the wafer 100 is conveyed to coater 20. The wafer 100 with which the photoresist was applied to the front face by coater 20 is conveyed to a position in readiness 30 by the robot arm 26. The wafer 100 of a position in readiness 30 is held at the articulated-robot arm 34 prepared in the aligner 12, and even the reader (bar code reader) 36 which reads the identification code (for example, bar code) formed in each class on a wafer 100 is conveyed. A reader 36 outputs the read information (conditions about the exposure when forming a pattern in each class, and alignment) to a main control unit 14.
[0013] The robot arm 34 moves further along with a guide 40, and delivers a wafer 100 to the turntable 44 of PURIARAIMENTO equipment 42. Rotating a wafer 100 on a turntable 44, it irradiates the parallel flux of light of non-exposing wavelength by the sensor 46 at the periphery section, and PURIARAIMENTO equipment 42 carries out photoelectrical detection of the flux of light which is not interrupted with a wafer 100. And rotation of a turntable 44 is stopped according to the output of a sensor 46, and the orientation flat of a wafer 100 is doubled in the predetermined direction. Then, a wafer is conveyed to the upper part of the wafer stage 47, and vacuum adsorption is carried out by the slider arm 48 at the wafer holder 52.
[0014] In two or more layers on a wafer 100, a pattern piles up, is formed and detects the alignment mark attached to the at least one pattern of two or more layers by the alignment sensor 56, respectively. And the wafer stage 47 is driven based on the predetermined amount of amendments (alignment conditions), and alignment of the pattern on a wafer 100 and the pattern on a reticle is carried out to the output of this alignment sensor 56. Then, the maximum upper layer on a wafer 100 (it is a wrap photoresist about it) is exposed by the image of the pattern on a reticle through projection optics 54. In addition, the calculation approach of the alignment conditions of a wafer 100 is explained in full detail behind.
[0015] By the slider arm 48, the wafer 100 by which superposition exposure of all the shot fields (pattern) was carried out by the pattern image of a reticle is taken out from the wafer stage 47, and is received and passed to the robot arm 34. Furthermore, a wafer 100 is conveyed by the robot arm 34 even to the laser-beam-machining equipment 38 which records the conditions about exposure and alignment on a wafer (the maximum upper layer) 100. Laser-beam-machining equipment 38 irradiates the laser beam of a wavelength region which exposes a photoresist on a wafer 100, and writes the conditions about exposure and alignment in a wafer (photoresist) 100 in the form of a bar code (or a figure and the alphabet).

[0016] Now, the wafer 100 with which various conditions were recorded is conveyed to a position in readiness 30 with the robot arm 34, and is further carried in to a developer 22 by the robot arm 26. The wafer 100 to which the development was performed with the developer 22 is carried in to test equipment 24 by the robot arm 26, and an alignment error is measured here. Test equipment 24 illuminates some shot fields on a wafer 100, respectively, and carries out photoelectrical detection of the light generated from a wafer 100 with an image sensor (for example, CCD). Furthermore, the picture signal from an image sensor is scanned with two or more scanning lines, the alignment error of the pattern formed in at least one layer on a wafer 100 and the pattern (resist pattern) which was exposed with the aligner 12 and which should be formed in the maximum upper layer is measured, and this measurement result is outputted to a main control unit 14.
[0017] Drawing 2 shows the configuration of the exposure section of an aligner 12. In drawing, the exposure light outputted from the exposure light source 60 illuminates the reticle 62 held in the reticle stage 64. The predetermined circuit pattern is formed in the reticle 62, and the pattern is projected on a wafer 100 through projection optics 54. the wafer stage 47 -- the stage drive system 68 -- the 2-dimensional XY direction -- a step -- it is movable. Alignment equipment 56 is specified quantity gap ****** from the optical axis of projection optics 54, and carries out photoelectrical detection of the alignment mark (not shown) attached to the shot field of a wafer 100. On the wafer stage 47, the reflective mirror 70 is fixed and the light outputted from an interferometer 72 is reflected. The light reflected by the reflective mirror 70 is received with an interferometer 72, and it has become as [detect / the location of the wafer stage 47]. The image formation property control unit 74 which controls the image formation property is connected to projection optics 54.
[0018] Drawing 3 shows the shot array of a wafer 100. The grid-like alignment marks Mxn and Myi by which photoelectrical detection is carried out by the alignment sensor 56 are formed in the street line of two or more shot fields ES1-ESN on a wafer 100. This example performs alignment of a wafer with the so-called EGA (en hunger strike global alignment) method. That is, the sample fields SA1-SA9 are chosen from from among two or more shot fields ES1-ESN, the alignment mark attached to these sample fields SA1-SA9 is detected, and a shot array coordinate (x y) is statistically searched for with a least square method.
[0019] Next, the exposure approach of a wafer 100 is explained with reference to the flow chart shown in drawing 4 . The exposure approach of this invention is performed based on the information saved in two databases and "the database 1" which are shown below, and the "database 2." At storage 16, the alignment residuum measured with test equipment 24 after exposure, and the exposure conditions and alignment conditions at the time of exposing are saved as "a database 1." The contents of "the database 1" are as follows.
(1) a routing -- a name -- (-- two --) -- exposure -- a device name -- (-- three --) -- exposure -- a reticle -- a name -- (-- four --) -- alignment -- a layer -- a process -- a name -- (-- five --) -- alignment -- a layer -- exposure -- a device name -- (-- six --) -- alignment -- a layer -- exposure -- a reticle -- a name -- (-- seven --) -- alignment -- conditions -- (-- eight --) -- alignment -- a residuum -- here -- alignment -- a layer -- having used it -- alignment -- a mark -- forming -- having -- **** -- a wafer -- 100 -- a top -- a layer -- it is .
[0020] The following amendment parameters are used as alignment conditions. First, it is (1) offset (x y) as an amendment parameter of the array coordinate of the shot field of a wafer 100.
(2) Scaling (x y)
(3) It is (5) shot scale-factor (6) shot rotation [0021] as perpendicularity (4) wafer rotation and an amendment parameter in each shot field. Wafer iD is recorded on each class of a wafer as "a database 2" for every exposure process. The contents of "the database 2" are as follows.
(1) Even if such information that is a routing name (2) exposure device name (3) exposure reticle name is not a wafer unit, it may be recorded on the lot unit which consists of two or more wafers.
[0022] In the exposure approach of this example, while selecting a routing, an aligner, and an exposure reticle as activity preparation first in advance of the alignment of a wafer 100, an alignment layer process name is specified. Next, the contents of the "database 1" saved by the main control unit 14 at the store 16 are read. On the other hand, the wafer iD (database 2) of the wafer 100 which should be exposed is read by the bar code reader 36, and the read information is read into a main control unit 14. It means that the information on both "a database 1" and the "database 2" was read now into the main control unit 14. In addition, when a routing name and an alignment layer process name correspond by 1 to 1, "it is not necessary to specify an alignment layer process name in activity preparation."
[0023] In a main control unit 14, six parameters shown below are set up from the read information.
(1) routing name (2) exposure device name (3) exposure reticle name (4) alignment layer process name (5) alignment layer exposure device name (6) alignment layer exposure reticle name [0024 --] Next, a control unit 14 searches "the past alignment conditions" and past "alignment residuum" corresponding to the six above-mentioned parameters from

the "database 1" of a store 16. At this time, the data to search may set up retrieval conditions like not all the past data but the "n newest data", or "the data within the newest n hours (or a day, the moon)." Thus, from the average of the searched data, the "new alignment conditions" (amendment parameter) of the wafer 100 which should be exposed is computed by the following formulas.

"New alignment conditions" = "the past alignment conditions of corresponding" - "Alignment residuum of the corresponding past"

Or depending on the system of coordinates of a vernier measuring machine (test equipment 24), it computes by the following formulas.

"New alignment condition" ="past alignment conditions of corresponding"+ "the alignment residuum of the corresponding past"

[0025] Next, a main control unit 14 amends the positional information of the wafer 100 detected by alignment equipment 56 according to the "new alignment conditions" computed as mentioned above, and performs alignment. That is, while driving the wafer stage 47 with a driving gear 68, the projection scale factor of projection optics 54 etc. is controlled by the image formation property control unit 74. A driving gear 68 performs it, migration of a wafer 100 acting as the monitor of the location (location of a wafer 100) of the wafer stage 47 with an interferometer 72. Sequential exposure of the image of the pattern on a reticle 62 is carried out to each shot fields ES1-ESN of a wafer 100 through projection optics 54 after alignment completion.

[0026] As mentioned above, although this invention was explained based on the example, this invention is not limited to this example and can be changed in the range which does not deviate from the summary as technical thought of this invention shown in the claim.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the mimetic diagram showing the exposure system concerning the example which applied this invention.
[Drawing 2] Drawing 2 is the mimetic diagram showing the configuration of the important section of the exposure system of drawing 1 .
[Drawing 3] Drawing 3 is the top view showing the wafer used for the exposure system of drawing 1 .
[Drawing 4] Drawing 4 is a flow chart which shows the exposure approach concerning the example of this invention.
[Drawing 5] Drawing 5 is a flow chart which shows the conventional exposure approach.
[Description of Notations]
10 ... Coater developer
12 ... Aligner
14 ... Main control unit
16 ... Storage
24 ... Test equipment
52 ... Wafer holder
47 ... Wafer stage
54 ... Projection optics
56 ... Alignment sensor
62 ... Reticle
68 ... Driving gear
70 ... Reflective mirror
72 ... Interferometer
74 ... Image formation property control unit
100 ... Wafer

[Translation done.]

* NOTICES *

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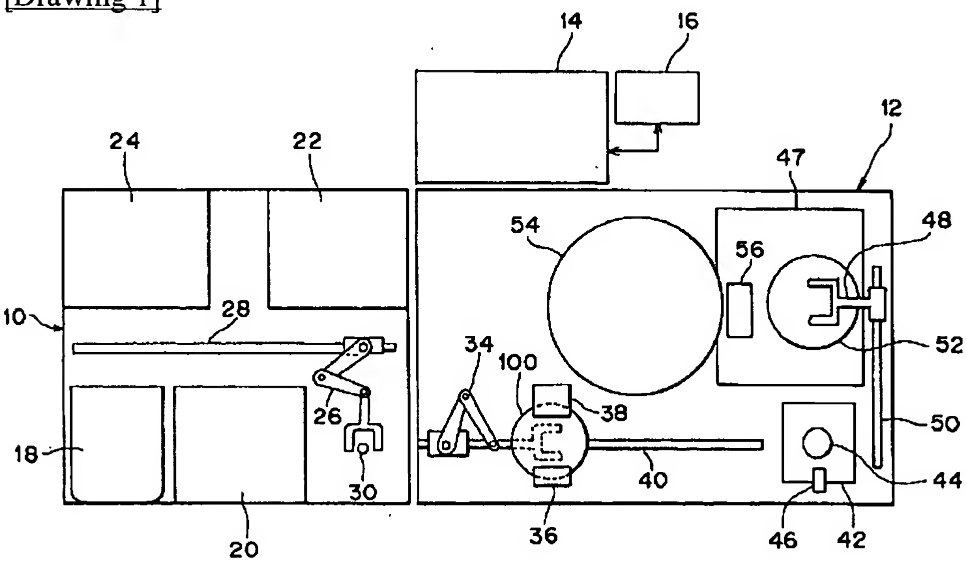
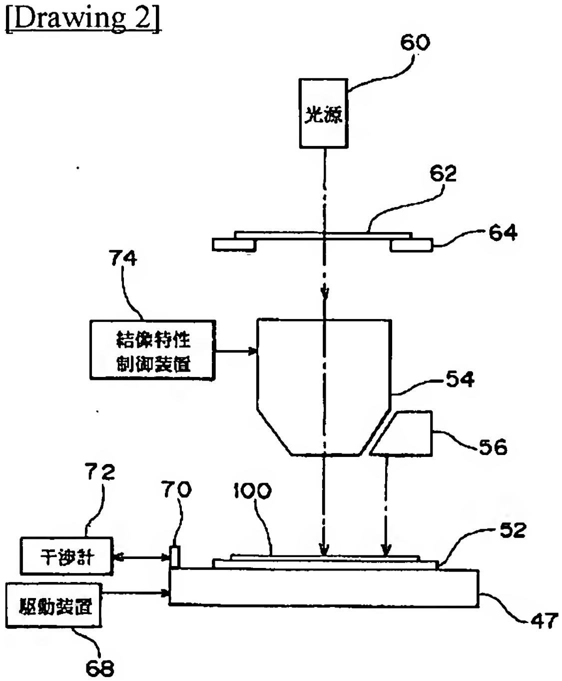
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

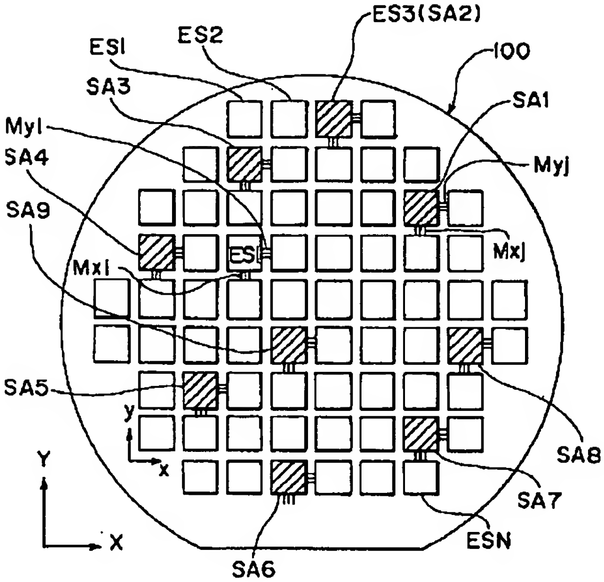
[Drawing 1]



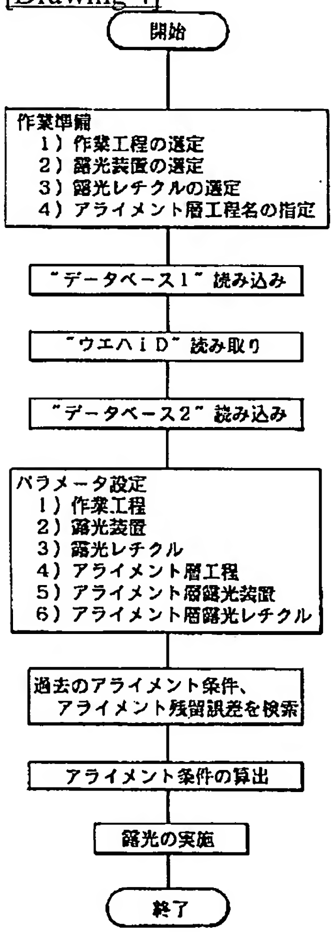
[Drawing 2]



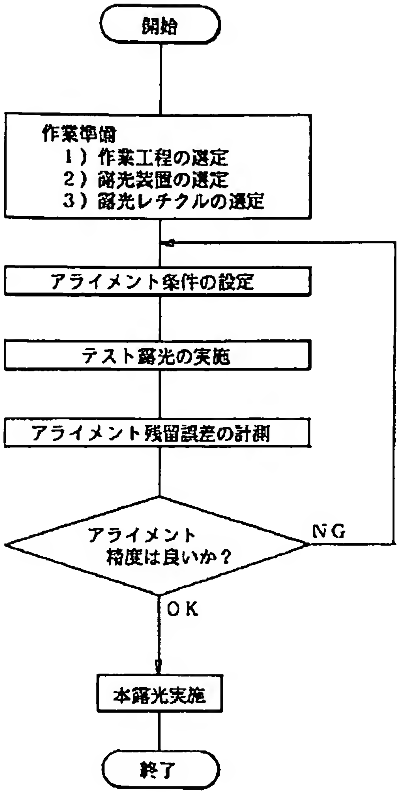
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]